AN INVENTORY
OF
USEABLE WASTE PRODUCTS
FOR
PRINCE EDWARD ISLAND
FARMS

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CHAPTER I

INTRODUCTION

Sustainability is an objective for the Prince Edward Island agriculture industry. A key to sustainability is maximal recycling of locally available resources with a view to reducing inputs from outside sources. Most farms in the province are intensive recyclers of organic by-products accumulated on the farm. Even with increasing farm unit specialization and movement away from the typical mixed farm of yesteryear, farmers still tend to make use of by-product from one farm as a resource on an adjacent or nearby one.

The need to quantify this system, and expand it to embrace the entire province as a recycling system, was the basis for a decision to carry out an inventory of useable waste products for the farm. The first step in planning and/or organizing any system is to obtain information of the existing resource base with regard to where it is located, its physical and chemical make-up, who owns or controls it and what is presently happening to it. The inventory attempts to provide this information for any waste materials on Prince Edward Island that would have on farm use in the existing state or as a basis for additional treatment.

The on farm use of waste products is generally limited to two options; as animal feed or as an agricultural soil amendment. Use of by-products as feed for livestock is well documented and understood, for example, cull potatoes as cattle feed, buttermilk and whey as pig feed, poultry offal and fish wastes as feed for fur bearers and cullage from vegetable grading and processing as general livestock feed. In addition, research is ongoing with regard to alternative processes for turning by-products into feed sources, for example the work being done to develop fish silage as a livestock feed source. In this inventory the use of by-products as animal fodder was recorded as part of the data collection, however the major emphasis was given to materials that would have potential as soil amendments. As a general comment, by-products being fed to livestock would not be considered a waste product, merely as an alternative use. Much of the "waste" in the province that is organically based has potential as a soil amendment, and it is that present waste that was deemed to need primary attention.

Utilization of wastes represents an opportunity for farmers, generators and our Island society as a whole. At the same time, we must be concerned that these products not be used in any way which causes harm to the environment or to human health. First and foremost in any utilization program must be the assurance that human health is not threatened nor the environment harmed by a products use. This calls for an understanding that use of these products only be undertaken in a responsible and sensitive manner. At the same time, it should be noted that present disposal practices have negative aspects; loss of soil nutrients, using up of landfill sites, increased probability of polluting ground and surface waters. Closing the circle, and recycling suitable wastes through the agriculture system, if done sensitively and cautiously can be a significant step for Islanders economically and environmentally.

In this inventory, the following products were investigated:

potato cullage
fisheries by-products
meat processing by-products
wood processing by-products
seaweeds
animal manures
sewage sludge
harbour dredgings
municipal leaf and yard waste
food processing waste
food service industry waste
waste hay and straw.

Factors examined for each waste product are:

1. The location and volume of each waste material
2. The availability of each waste product, including ownership and cost
3. The form and condition of waste materials
4. The extent of present use of waste materials.
5. Other information as to composition, nutrient content etc. as available.

Telephone interviews formed the basis for data collection. This allowed for almost total coverage of target groups. A questionnaire and information outline was prepared that was used in gathering data, it was tested in materials categories of low volume (harbour dredging, leaf collection) and revised prior to use in major category areas. On-site examinations of materials and further interviews were carried out as need for further detailed information became apparent.

Contact lists were established in a number of ways. Government departments, in particular the P.E.I. Departments of Fisheries and Aquaculture, Environment, Community and Cultural Affairs, Forestry, Parks and Agriculture were especially supportive in supplying potential interviewees. Commodity and manufacturing groups and organizations as well as local and municipal officials were also helpful in this regard. Establishing lists of interviewees was a significant aspect of the total project.

It should be pointed out that the volume and tonnage figures provided in this inventory are rough estimates at best. It seems to be a common human trait to maintain accurate records of product output while considerably less attention is paid to by-product or waste accumulation. This makes any inventory of by-product difficult to obtain with any degree of precision. In many cases, the process used was to obtain information with regard to total raw product processed, or total product output and then through developing a series of conversion factors, assess an amount of waste based upon raw product and/or finished product numbers. The conversion factors used are also based upon average estimates and actual volumes may vary considerably depending upon physical and chemical make-up and in particular, moisture content.

These inventory values should then be considered general first level values or indicators. They are certainly of adequate precision for planning and preliminary interest and evaluation studies. However, additional detailed specific evaluations of product would have to be carried out prior to a major project development. This inventory might be compared to a road map; it will show you how to get there, but the actual details will have to be discovered upon arrival; happy motoring!

CHAPTER II

ANIMAL MANURE

Almost every farm on Prince Edward Island maintains some livestock. Even specialized horticulture based farms such as potato operations will often keep beef cattle to make use of potatoes culled during the grading operation. Livestock husbandry has a long and distinguished history in the province. This coupled with the tendency to maintain mixed farming operations until very recently has contributed to the continued presence of livestock on most Island farms. With livestock comes manure, traditionally prized as a soil amendment and enhancer. Animal manure was regarded as the principal fertilizer until after the Second World War and the advent of commercially prepared fertilizers. It is still recognized as an important fertility component on many farms in the province and as a result of an increased awareness of maximizing the use of on farm resources, new efforts are being made to ensure it is used to a maximum level of efficiency.

An estimated 1.5 million tons of animal manure is produced on P.E.I. annually; enough to apply 3 tons per acre to all the improved farm land in the province annually for an indefinite period! One of the most interesting results of this survey is that only about 1% of the entire animal manure production of the province ever leaves the farm on which it originated. Most livestock production in the province is an integrated part of the whole farm operation with manure being considered as part of the fertility cycle.

In conducting the inventory farms which were assumed to use all the manure they produced in the farm cycle were not contacted. For example, dairy operations, mixed farming operations, sheep farmers, horse owners and others with an adequate land base were not included in the survey. All the major poultry producers were interviewed as were large cattle feeder operations. Institutions and facilities such as stables, race tracks, the veterinary college, livestock exhibitions, etc. were contacted. The list of hog producers in the province was reviewed with the provincial swine specialist and any producers that might have manure in excess of what they used on-farm were contacted and interviewed. Thus, this part of the inventory concentrated on types of operations with the following criteria:

-A high concentration of animals in a few locations,
-Animals confined for all or much of the year,
-Operation that have little or no need for manure as a soil amendment or cannot use the full amount produced.

Approximately 9,300 tons of solid manure is removed from the originating facility annually. An additional 1,357,000 gallons of liquid hog manure is also not used on the originating farm operation. The vast majority of this manure is used by other farmers in the neighbouring communities. The hog manure in liquid form is in demand for use on potato, grain and soybean land. It is sold in some instances, moved for transportation costs in others and in some cases the hog farmer will spread it on another farmers land at no cost to the land owner. In areas of heavy potato production, the liquid manure can most often be sold due to a greater local demand for fertility enhancements.

Manure from laying hens is just straight feces and urine without any bedding. It is a strong product and requires careful handling and application to avoid damaging crops. Only one egg producer has a problem disposing of his manure production, the rest of it is used on pastures, potato or grain land and on orchards. The broiler chicken industry is undergoing a small rebirth in the province. This chicken manure is combined with bedding (usually shavings) and would be highly desirable, particularly in a compost mixture. However, due to the beginning nature of industry, manure is presently being stockpiled on the broiler farms until some decision is made with regard to its use.

The mushroom plant in Lower Freetown makes use of all the horse manure from the Summerside Raceway as well as the Charlottetown Driving Park complex in its compost preparation as a substrate for mushroom production. All of the small exhibitions in the province contract local farmers to haul any manure accumulation as a result of livestock shows. Only the provincial exhibition in Charlottetown has any significant disposal requirements and they are contracted to a local sanitation company which hauls the approximately 500 tons of manure and bedding to a landfill site. A major riding and boarding stable in the

Charlottetown area accumulates approximately 1200 tons of horse manure annually. Disposal is both an expense and a problem.

The Atlantic Veterinary College produces about 950 tons of mixed manure annually. Removal is contracted to a local sanitation firm. Some of the manure is used in a composted operation by a berry farmer.

Presently over 99% of the total animal manure production in the province is being used either on the farm on which it originated, or in some neighbouring agriculture endeavour. Something in excess of 500 tons annually finds it way to a land fill. One egg producer has manure disposal problems while two broiler producers are presently stockpilings manure on-farm. About 1000 tons of poultry manure annually is not being utilized. A riding stable has a problem disposing of approximately 1200 tons of horse manure annually.

Animal manure is generally viewed as a resource in Island agriculture and only in rare instances as a waste and/or a disposal problem. The maximizing of the nutrient value of animal manures and the careful use and application is an area that would seem to be requiring of most attention at present as opposed to disposal problems which tend to be rare and isolated.

TABLE 1 - TOTAL NUMBER OF ANIMALS AND MANURE PRODUCTION ON P.E.I.

	NO. OF ANIMALS[1]	MANURE PRODUCED (T./yr.)
Cattle		
Cows		
Dairy	21,805	424,200
Beef	11,829	123,600
Heifers	21,857	163,500
Steers and Bulls	20,627	225,900
Total Pigs	114,836	453,600
Total Sheep	6,795	5,200
Total Horses and Ponies	2,357	21,300
Total Hens and Chickens	256,656	9,900
	TOTAL	1,427,200

[1]From 1986 Census of Agriculture

Assumptions for calculating manure production (1986, Maine Useable Waste Products For The Farm, State of Maine):

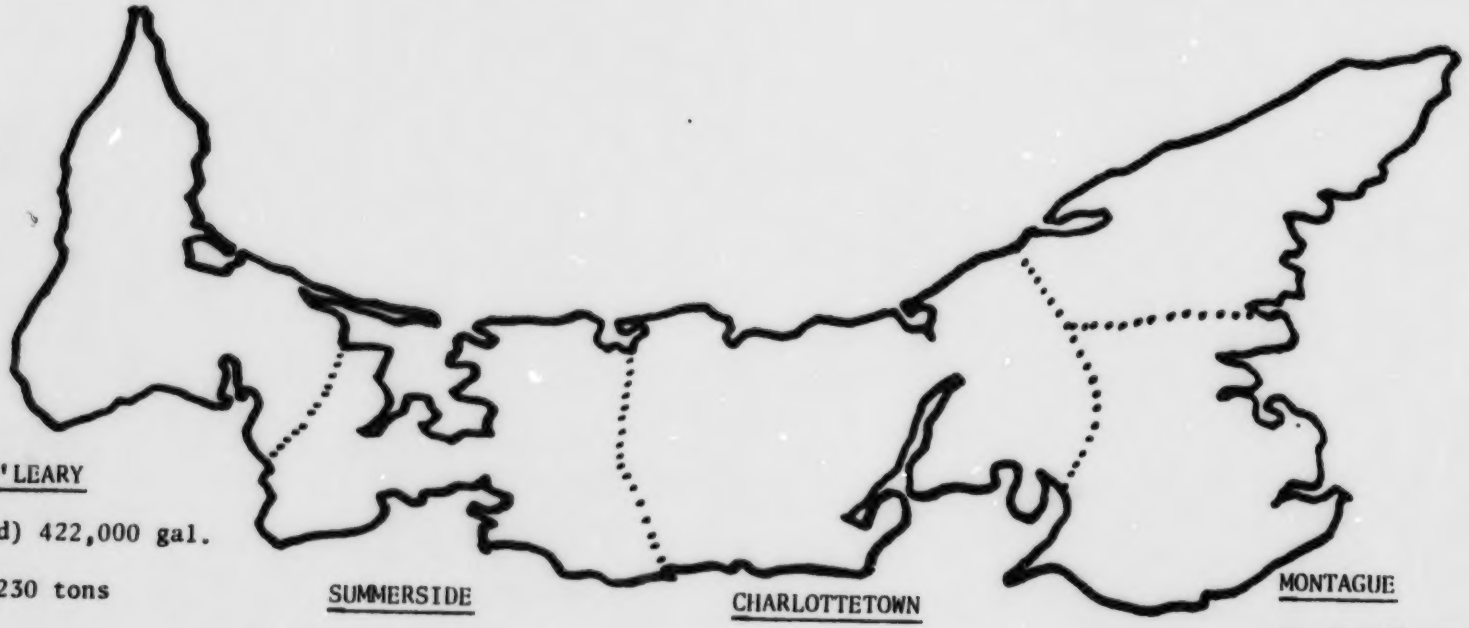
Animal Type	AU/Animal	Lbs. Manure/day/AU
Dairy Cattle	1.3	82
Heifers	0.5	82
Beef Cattle	1.0	60
Chickens	0.004	53
Horses	1.1	45
Hogs	0.333	65
Sheep	0.105	40

TABLE 2 - MANURE DISPOSED OF ELSEWHERE THAN ON FARM OF ORIGIN

AGRICULTURE DISTRICT	MANURE TYPE	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	Hog (liquid)	422,000 gal/yr.	spring and fall	soybeans, grain, potato land
	Hog (dry)	230 T/yr.	on demand	mixed farm land
Summerside	Hog (liquid)	470,000 gal/yr.	spring and fall	potato and grain land
	Hog (dry)	200 T/yr.	year round	potato land
	Poultry (hen)	700 T/yr.	spring and fall	pasture, potatoes, grain
	Cattle	3,200 T /season	200 T/wk Dec.-Mar.	neighbouring farmers
	Horse	200 T/yr.	contracted	mushroom plant
Charlottetown	Hog (liquid)	465,000 gal/yr.	spring and fall	vegetables, grain, potatoes
	Poultry (hen)	625 T/yr.	fall	partially used
	Poultry (broiler)	480 T/yr.	stockpiled	stockpiled
	Horse	2450 T/yr.	1200 T available 750 T contracted 500 T (Aug. only)	stockpiled and spread mushroom plant landfill
	Mixed manure	950 T/yr	contracted (weekly)	composted (strawberries)
Montague	Poultry (hen)	300 T/yr.	spring and fall	orchard, pasture
Province wide	Mix manure	minimal amount	used locally	

TOTALS:	
HOG (LIQUID)	1,357,000 gal/yr.
HOG (DRY)	430 T/yr.
POULTRY (HEN)	1,625 T/yr.
POULTRY (BROILER)	480 T/yr.
CATTLE	3,200 T/yr.
HORSE	2,650 T/yr.
MIX MANURE	950 T/yr.

FIGURE 1 - DISTRIBUTION OF EXCESS ANIMAL MANURE ON P.E.I.



O'LEARY

Hog(liquid) 422,000 gal.

Hog(dry) 230 tons

SUMMERSIDE

Hog(liquid) 470,000 gal.

Hog(dry) 200 tons

Poultry(hen) 700 tons

Cattle 3,200 tons

Horses 200 tons

CHARLOTTETOWN

Hog(liquid) 465,000 gal.

Poultry(hen) 625 tons

Poultry(broiler) 480 tons

Horse 2,450 tons

Mix Manure 950 tons

MONTAGUE

Poultry(hen) 300 tons

CHAPTER III

WASTE HAY AND STRAW

There is essentially no spoiled/waste straw in the province. According to those interviewed during the project, if straw is baled rather than chopped and ploughed down, it is used. The amount of straw that is baled and then found to be unuseable is negligible.

Waste or very poor quality hay is another matter. Hay quality varies considerably from year to year dependent upon weather primarily. According to the Island Hay and Straw Cooperative 1990 was an excellent year for hay making and waste was minimal. The point is also made that information and technology is having a marked effect on improving the quality of hay that is being processed in the province, thus there is less wasted hay than was formerly the case.

There is no concentration of waste hay; what is available is spread across the province in direct relation to the distribution of livestock. This makes obtaining an inventory with any degree of precision difficult
In order to get some valid indication of the availability of waste and poor quality hay interviews were carried out with the general manager of the Island Hay and Straw Cooperative as well as five cooperative members from all the major haymaking areas of the province. Their observations are collated below.

Firstly, there is more waste hay in the large round bale format of haymaking than with small square bales. This is in large part due to the impression that round bales can be left outdoors indefinitely without being covered. It is also due in part to the observation that often normal hay amounts are put up using the square baling equipment that the farmer has and any excess is contracted to be done in round bales by a custom operator. These situations are changing with increased knowledge and refined round bale preserving techniques.

Secondly, it was noted that most farmers will have some questionable hay in their barns that they will use as a last resort, should it be required out of necessity. To quote one farmer, " Just about everyone has a few hundred bales in their barn in the late spring that was questionable when it was put in and they didn't need to feed it. If they could get twenty cents a bale for it, they would be happy to see it gone to make way for the next crop."

Based on the above information, it was arrived at that about five percent of the hay in the province is of such poor quality that it could be aquired for essentially out of pocket baling costs, particularly in late spring - early summer. This figure of five percent was agreed to be quite realistic by those persons interviewed. Using this figure, based on the 1990 hay crop estimate of 320,000 tons; it can be assumed that about 16,000 tons of poor quality - waste hay is available for out of pocket baling costs in a normal crop year. Hauling costs will vary but as a general guideline, the Island Hay and Straw Coop charges $7.50 per ton to haul to Rustico from anywhere in the province, based on the seller loading. If loading is valued at about $3.50 per ton then $11.00 per ton to load and transport waste hay is a valid estimating figure.

The Hay and Straw Coop manager made the point that if an option existed to retrieve or ensure that out of pocket baling costs were covered (that is, if value of waste hay approximately equalled baling costs) then more hay which was of questionable value would be put up. This would be of mutual benefit since much of the questionable hay would be of saleable quality, and that which was not would find its way into a composting or some other processing system. It would also be better for farmlands since it would assist in controlling weeds and take poor quality hay off fields rather than leaving it there.

In summary; about 16,000 tons of poor quality - waste hay is available in a normal year. Loading and hauling costs can be estimated at approximately 11.00 per ton. The cost of waste hay would be approximately equal to the out of pocket baling costs. There is no waste straw in the province.

CHAPTER IV

POTATO INDUSTRY CULLAGE

The potato industry is the economic flagship of Prince Edward Island. In the last decade in the vicinity of 70,000 acres have been committed annually to potato production. In that period the total value of the Island potato crop has varied between 44 and 127 million dollars. A long time problem for the potato industry has been the utilization and disposal of cull potatoes. Culls are potatoes that are not marketable for their intended use for a variety of reasons. The term is generally taken to mean damaged, diseased or malformed tubers as well as those under two inches in diameter in some situations.

Cullage is variable in the extreme from year to year. It is dependent upon level of production, North American price and demand, weather conditions during the production season and a host of other matters that affect the potato industry generally.

Initially the inventory was to include a survey of all the major packing shed operations in the province to obtain a detailed picture of cullage rate, usage and other information on an agriculture district basis. The discovery of the PVY^n virus in seed potatos from P.E.I. threw the entire potato industry in a state of chaos at the same time the inventory was being conducted. It was decided that it would be impossible to obtain accurate data given the state of the industry. As an alternative, it was agreed that a general provincewide background of cull availability and usage should be developed as an accompaniment to the rest of the waste products inventory.

A telephone survey of large tablestock grading and packing operations was carried out. This was concentrated in areas of major potato production and yielded general indications of cull rate, cull usage, form and condition of the product. Agriculture Canada potato disappearance data was used for comparision purposes. A report prepared by the Prince Edward Island Food Technology Centre; Mepham and MacEwan, 1990, To Quantify and Qualify Potato Packinghouse Culls, was used extensively as were cull potato burial files from the P.E.I. Department of Agriculture.

Since 1978 the cullage rate for P.E.I. potatoes has varied from 12.7% of total crop to 31% of the total production according to Department of Agriculture statistics. Total amount of cullage per season is more than double from low to high years: 2.1 million hundredweights in 1983 and 5.64 million hundredweights in 1982. As a percentage of the total crop, 1989 was the lowest cullage year in the last twelve. Strong markets and good growing and storage conditions combined to result in 12.7% cull rate, with 2,353,102 hundredweights not making the grade standards. Growing conditions in 1990 were irregular with near drought conditions for part of the season followed by difficult harvest conditions. Cullage to date (end of February, 1991) for the 1990 crop is estimated at 16.4% according to Agriculture Canada potato disappearance figures, however, discussions with packers indicate that the cull level might be close to 20% to date in the table stock markets. It is unknown at this time what effect the loss of seed stock markets as a result of PVY^{n} virus may have on total cullage for the 1990 crop.

The potato, dairy and beef industries form a closely linked triangle on Prince Edward Island. The beef industry is in large part based upon non-milking progeny of the dairy industry (steers, culled cows and beef cross progeny of dairy cows). The beef industry and to a lesser degree the dairy industry, depend to a large extent upon a supply of cull potatoes for feed. The dairy industry counts on the beef industry as a market for their non-milking progeny. This relationship has evolved through the years as agriculture moved from a mixed farm base, where many farmers produced dairy products, beef and potatoes on the same farm to the more specialized farms of today. The linkage still exists to the benifit of all, but it is more of a symbiotic relationship among a number of farms than was formerly the case. This relationship is dependent upon cattle feeding operations being within a reasonable distance of potato growing areas, since it is impractical to truck cull potatoes long distances, particularly if other sources of feed are available. According to interviews, this is beginning to be a problem in the Souris district where there are not large numbers of cattle, but an active potato industry.

While potatoes that may not meet grading criteria for a number of reasons can be fed to livestock (i.e. small potatoes, cut, bruised, misshapen, etc.), a certain percentage of the cullage is not suitable for stockfeed (i.e. diseased, rotted or spoiled, etc.). Estimates from various sources place

minimum annual cullage that will be not be fed to livestock at about 15,000 tons annually. In an "average" year it is estimated that about 25,000 tons of potatoes that are culled will not be suitable for livestock feed. These are the cullage that would normally go to burial or some other form of disposal.

The beef industry depends to some extent on the existence of cull potatoes as an inexpensive feed source. The dairy industry tends to look to cull potatoes more opportunistically, feeding when they are abundant and available. Guidelines for feeding potatoes are a maximum of 40 pounds per day to milk cows while beef cattle can consume 10 to 12% of their body weight per day. The average price for cull potatoes for feed is 0.5¢ per pound ($10 per ton). As the accompanying graph illustrates, the feedlots can accomodate cull potatoes to a maximum of about 19% of the total annual production of potatoes on P.E.I. They are unable to make use of cullage much beyond that point. In years when the cullage rate is below that, the beef and dairy industries compensate by switching to other sources of feed and/or reducing herd size.

It can be assumed that approximately 19% of the total potato production can be used as a valued alternative feed in the cattle industry of P.E.I., should the cullage rate be that high. It is interesting to note that the cull rate is dropping on average with time as post-harvest handling and storage become more sophisticated and more carefully controlled. Alternative uses in processing operations may also drop the overall cullage rate through time. It is interesting to note that the modified average cullage rate for the 1978 -1989 period is 17.6% indicating that the cattle industry is more or less accomodated to the availability of culls on the Island.

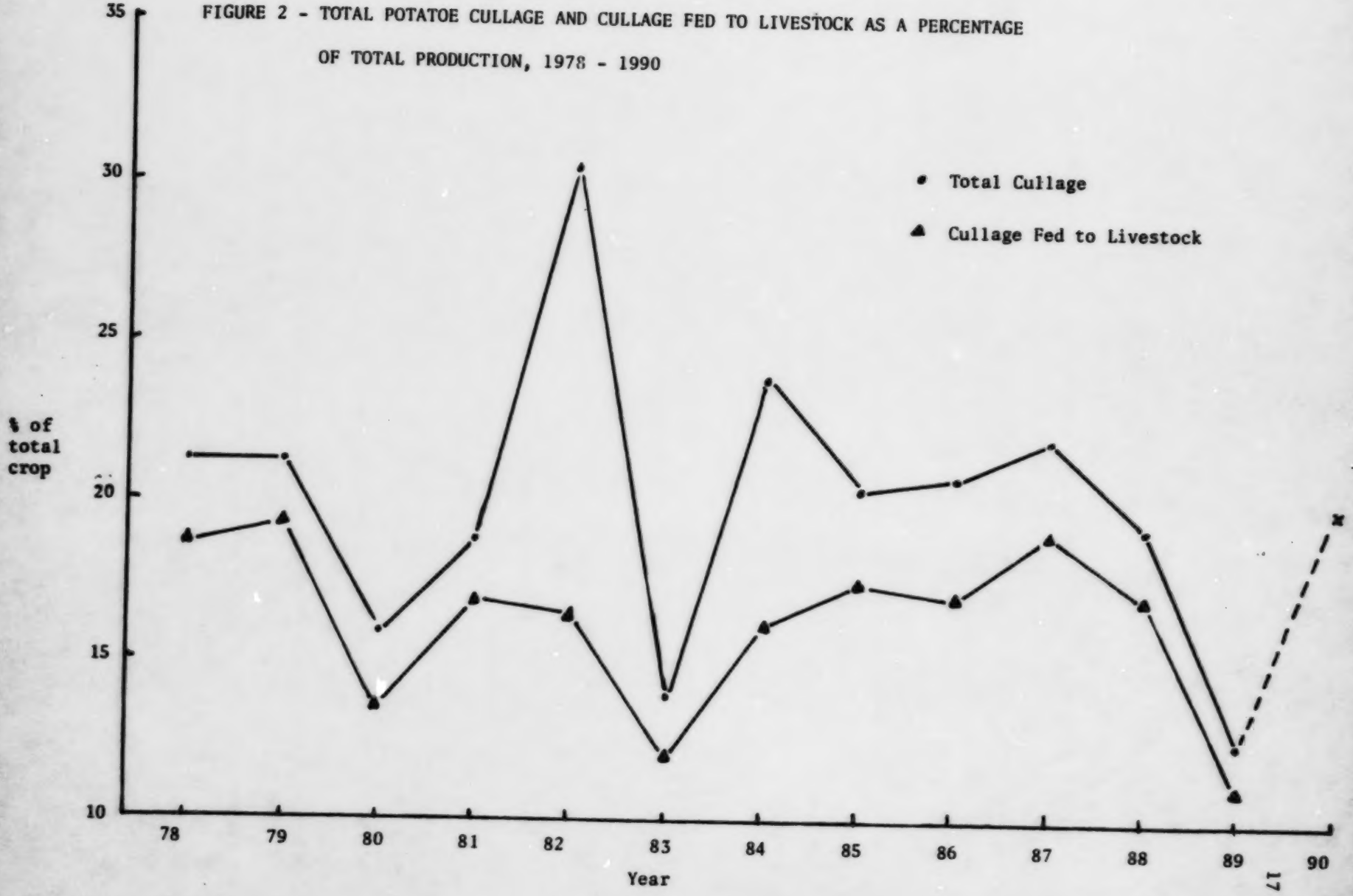
There is a need to dispose of a minimum of 15,000 tons of non-feedable culls annually. Burial, the choice most often used to date, is not looked upon favorably as a long term solution. Potential for groundwater contamination and disease retention are among the concerns with burial as a disposal alternative. Composting was shown as a desirable alternative in the 1990 feasibility study (Brinton, 1991). It is the technique to be used to dispose of the PVY^{n} infected or suspected stocks during the summer of 1991. In addition, packers in the eastern end of the province are examining composting as an alternative disposal method for culls in their area due to a lack of demand for livestock feed.

Unfortunately, cullage beyond that required by the livestock industry is extremely variable. It is where all the "excess" in the system settles out. Any comprehensive approach to composting of cull potato wastes would have to be extremely flexible. It could be based on the background level of 15,000 to 25,000 tons per year but would have to be almost infinitely expandable in order to accomodate conditions in most years.

TABLE 3 - CULLAGE AND END USE OF POTATOES (1978-1989)

CROP YEAR	TOTAL PRODUCTION (cwt)	CULLAGE (cwt)	%	PROBABLY TO BURIAL (cwt)	%Crops	%Culls	PROBABLY TO FEED (cwt)	%Crop	%Culls
1978	12,386,000	2,626,400	21.2	300,000	2.4	11.4	2,326.400	18.8	88.6
1979	15,547,000	3,304,600	21.3	304,600	2.0	9.2	3,000,000	19.3	90.8
1980	13,217,000	2,112,800	16.0	300,000	2.3	14.2	1,812,800	13.7	85.8
1981	16,165,000	3,050,006	18.9	300,000	1.9	9.8	2,750,006	17.0	90.2
1982	18,191,555	5,637,058	31.0	2,637,058	14.5	46.8	3,000,000	16.5	53.2
1983	15,103,760	2,095,131	13.9	300,000	2.0	14,3	1,795,131	11.9	85.7
1984	18,529,073	4,435,556	23.9	1,435,556	7.7	32.4	3,000,000	16.2	67.6
1985	17,213,883	3,515,502	20.4	515,502	3.0	14.7	3,000,000	17,4	85.3
1986	17,592,361	3,675,585	20.9	675,585	3.8	18.4	3,000,000	17.1	81.6
1987	15,861,910	3,497,104	22.1	497,104	3.1	14.2	3,000,000	19.0	85.8
1988	18,083,365	3,471,772	19.2	300,000	1.7	8.6	3,171,772	17.1	91.4
1989	18,518,320	2,353,012	12.7	300,000	1.6	12.8	2,053,012	11.1	87.2

FIGURE 2 - TOTAL POTATOE CULLAGE AND CULLAGE FED TO LIVESTOCK AS A PERCENTAGE OF TOTAL PRODUCTION, 1978 - 1990



CHAPTER V

MEAT PROCESSING BY-PRODUCTS

The thirteen federally and/or provincially inspected slaughterhouses across the province were contacted in this section of inventory. They were all very helpful and forthcoming with information, showing a particular interest in the need to make better in province use of waste products. Three slaughterhouses with provincial certification were not in business or could not be contacted during this time period.

A system presently exists in the province for the pick-up of offal, bones and fat from slaughterhouses. A New Brunswick based rendering plant has a regular pickup system to handle these products. Until recently, the pick-up was carried out in exchange for the materials collected and seemed to work well. A per trip collection charge has been instituted since late 1990 and only the three or four largest slaughterhouses are paid anything for the waste product. It was noted that this system places a significant additional cost on the smaller facilities in the province.

Hides are collected from all the slaughtering facilities in the province by a local agent who then sells them to an off Island tannery. No fees are charged for collection nor is anything paid for the hides.

Blood is collected at three facilities. Garden Province Meats in Charlottetown has it collected by the rendering business. The other two plants have it land spread on hay fields in the vicinity. There is a significant nutrient value in blood and it tends to markedly improve hay yield according to one operator who spreads it on his own land. Blood is noted by Rodale (1978) as an excellent source of rapidly available nitrogen. The hauling of blood is done by tank trucks from septic system cleaning businesses. One slaughterhouse pays about $15,000 per year for blood hauling and spreading, the other pays about $2,000 per year.

The only poultry processing facility in the province has all its offal in demand by fur producers who take it fresh for animal feed. Feathers are buried in a private land fill facility.

The production of meat processing by-products is relatively constant from year to year. Approximately 5,275 tons of offal and waste is produced per year in the province. Some 94% of this waste is produced in the Charlottetown District. About 352,000 gallons of blood are collected annually in addition to about 2,250 cubic feet of feathers. The make-up of offal varies considerably depending upon what is predominantly being processed. In a facility that primarily processes hogs, about 22% of the waste is bone, the rest is fat and entrails. In a facility that processes primarily cattle, the percentage of bone is somewhat higher.

The by-products of the meat processing industry are used extensively at present, however very little of it remains in the province. For example, about 1,300 tons of bones leave the province annually. Raw bone meal contains about 2 to 4 percent nitrogen and 15 to 25 percent phosphorus (P_2O_5). Blood is not used to its best advantage, but is looked upon as something of a disposal problem. While slaughter house by-products can be composted, the provincial director of environmental health made the point during the inventory that a rodent problem could be of significant public health concern in any composting operation making use of animal based waste products. He suggested a rendering facility in the province might be an answer depending upon economic feasibility.

TABLE 4 - MEAT PROCESSING BY-PRODUCTS

AGRICULTURE DISTRICT	LOCATION	FACILITY	TYPE OF WASTE	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	O'Leary	Slaughterhouse	fresh offal	80 T/yr.	contract	rendered
Summerside	Summerside	Slaughterhouse	fresh offal	38 T/yr.	contract	rendered
			fat & bones	114 T/yr.	contract	rendered
Charlottetown	Clyde River	Slaughterhouse	fresh offal	125 T/yr.	contract	rendered
	Crapaud	Poultry Killing Plant	entrails	63 T/yr.	contract	fresh to fur farmers
			feathers	2250 cu ft/yr.	hauls to pit	buried
	N. Wiltshire	Slaughterhouse	fresh offal	145 T/yr.	contract	rendered
	Dunstaffinage	Slaughterhouse	fresh offal	38 T/yr.	contract	rendered
	Springvale	Slaughterhouse	fresh offal	53 T/yr.	contract	rendered
	Cornwall	Slaughterhouse	fresh offal	39 T/yr.	contract	rendered
	Ebeneezer	Slaughterhouse	fresh offal	425 T/yr.	contract	rendered
			blood	200,000 gal/yr.	contract	spread on hay land
	Winsloe	Slaughterhouse	fresh offal	42 T/yr.	contract	rendered
	Charlottetown	Slaughterhouse	fresh offal	4000 T/yr.	contract	rendered
			blood	116,000 gal/yr.		hauled to New Brunswick
Montague	Murray River	Slaughterhouse	fresh offal	8 T/yr.	hauls to pit	buried
	Pooles Corner	Slaughterhouse	fresh offal	105 T/yr.	contract	rendered
			blood	36,000 gal/yr.	septic tank truck	unknown

TOTALS: 5,275 T/yr. Fresh Offal

352,000 gal/yr. Blood

2,250 cu. ft. Feathers

FIGURE 3 - MEAT PROCESSING FACILITIES AND BY-PRODUCT AMOUNTS

O'LEARY

Offal 80 tons

SUMMERSIDE

Offal 152 tons

CHARLOTTETOWN

Offal 4,930 tons

Blood 316,000 gal.

Feathers 2,250 cu.ft.

MONTAGUE

Offal 113 tons

Blood 36,000 gal.

PROVINCIAL TOTALS:

Offal 5,275 tons

Blood 352,000 gal.

Feathers 2,250 cu.ft.

▲ LOCATIONS OF PLANTS

CHAPTER VI

FOOD PROCESSING WASTES

This section presents information on a group of industries diverse in size, product and waste treatment. One aspect deals with vegetable producers and graders exclusive of potato growers which are dealt with in a separate chapter. Another part of the chapter explores wastes from potato processors while yet another examines waste from dairy product processors.

A. Vegetable Processing Wastes.

There are eight vegetable grading and packing locations on Prince Edward Island. Root crops; carrots, turnips and parsnips as well as cole crops; cabbage, brussel sprouts etc. are the principle vegetables grown. In addition, there is a mushroom producing facility which is included in this section.

There is about 2,200 tons of vegetable cullage and trimmings available per year. The majority of it is carrots, the remainder being turnips, cole crops and some parsnips. It is all used as food for livestock, primarily cattle. The Vegetable Growers Cooperative sells cullage for 1.6¢ per pound at the plant. The rest of the material is bartered, given away for removal costs or sold for a minimal amount.

The mushroom plant has two waste products; mushroom culls and stumps as well as spent compost. Almost 30,000 cubic feet of culls and stumps are landfilled annually. About 108,000 cubic feet of spent compost is available annually. Some of the spent compost is taken by farmers to use as a soil additive but disposal is often a problem. The compost has potential as a soil amendment, an analysis of material in September of 1990 indicates a carbon content of 8.9%, calcium 2.7%, potassium 0.56% and phosphorus 0.24%. The spent compost was 47% dry matter and the C:N ratio was 11.8. Potential uses for the spent compost are as a method of adding organic matter to soils and lightening heavy soils. There is also an opportunity to recycle this material again through a composting system as a carbon carrying bulking agent.

B. Dairy Processing Wastes.

All of the dairies on Prince Edward Island which are producing products other than only fluid milk were contacted as part of the inventory, with the exception of one major dairy in Charlottetown which was in receivership at the time of the inventory and could not have supplied meaningful data due to the marked production changes that were taking place.

Fluid milk dairies have minimal amounts of waste. As a rule any spillage, etc. goes into the normal washing system. Other amounts of by-product are insignificant.

There are still two creameries in the province producing butter from farm separated cream. All of the buttermilk produced as a by-product of the churning process is contracted annually by farmers in the local area and is used to feed hogs.

A major cheese production plant in Summerside has approximately 8 million gallons of whey to dispose of annually. Presently less than 10% of the whey is contracted as feed for pigs. The rest is disposed of through the Summerside sewage treatment plant. The dairy is exploring the option of an evaporation system to concentrate the nutrients in the by-product and expressed no desire to develop an alternate usage system with long term committments.

Whey consists of about 93% water with small amounts of other milk constituents. The most abundant of these is lactose which makes up about 5% of the by-product. Fat, protein and minerals are also found in whey in lesser amounts. In addition to having potential as a feed substitute, whey is used in other locations as a soil amendment. It contains fairly well balanced amounts of N-P-K as well as several minor nutrients. The nitrogen in whey is almost all organic and it becomes rapidly available to plants when applied - 30 to 60 percent of the organic nitrogen is available to plants in the first growing season. The high water content of whey makes it difficult to apply agronomically appropriate amounts of it since several thousand gallons of liquid have to be spread on each acre to be fertilized. This can cause problems on clay or other soils with poor structure.

C. Potato Processing Wastes.

At present the largest industries on Prince Edward Island are frozen potato product manufacturing plants. One has been in operation for a number of years and is undergoing a major expansion. Another, which will manufacture potato specialty products as well as standard frozen potato items (french fries) is presently in the initial phases of production having just been constructed. A potato chip manufacturing plant has operated in the province for the last few years.

The potato chip plant has two types of waste; peelings and culls as well as graded out potato chips. About 45 tons per year of off grade potato chips are produced. These are taken by a local farmer and fed to pigs. The peelings and culls are taken to a cull burial site in the St. Nicholas area. The peeling process involves a lye solution making the by-product of limited value. Approximately 650 tons of peelings and culls are disposed of annually.

The major operating french fry plant in the province has two types of waste. Solid waste, which consists of peelings, off grade product, "slivers" and edges of potatoes amounts to some 40,000 tons per year. A contract arrangement is in place with a trucking company which hauls the by-product to farmers who use it for livestock feed. It is usually all subscribed, but price and demand vary with a number of factors, including grain prices, alternative sources of feed, availability of cull potatoes, etc.

Sludge from the sewage treatment system associated with the french fry plant is the other by-product. An estimated 440 tons (dry weight) of sludge will be removed from the settling ponds annually after the proposed plant expansion. It has been land spread on farm fields to date and this will likely be its disposition in the future. The sewage treatment system is operated by a company separate from the potato processing operation and sludge disposal is the responsibility of that company. Form and condition of materials from this major industrial undertaking is not readily available and is for the most part considered confidential. However, other than an absence of pathogens, etc. this sludge will exhibit many of the same characteristics as any other sludge. It will be high in organic content and display some valuable soil amendment qualities. The major constraint to the use of this material is one of odour. That has been overcome to some degree by a rapid incorporation of spread materials into the soil. Experiments with composting of dewatered sludge in other

jurisdictions have met with some measure of success. All of the sludge presently being cleaned from this operation is being transported to the new potato processing plant to seed their settling and biodegradation ponds.

As yet there is no waste products from the new potato specialty manufacturing operation recently constructed in the Albany area. However, plans indicate that they will incorporate all waste from the plant into one waste stream which will go through the waste treatment process. That is, there will not be any solid waste by-product from plant operations. It is anticipated that approximately 2000 tons of dewatered sludge will be removed annually from the settling and biodegradation ponds. This dewatered sludge will be 12 to 15% solids and thus will appear as a semi-solid. Present plans are to land spread this by-product as a soil amendment on fields in the area. Once again, form and condition of materials is not readily available information, however the general comments made with regard to other potato plant sludge is applicable.

TABLE 5 - FOOD PROCESSING WASTES

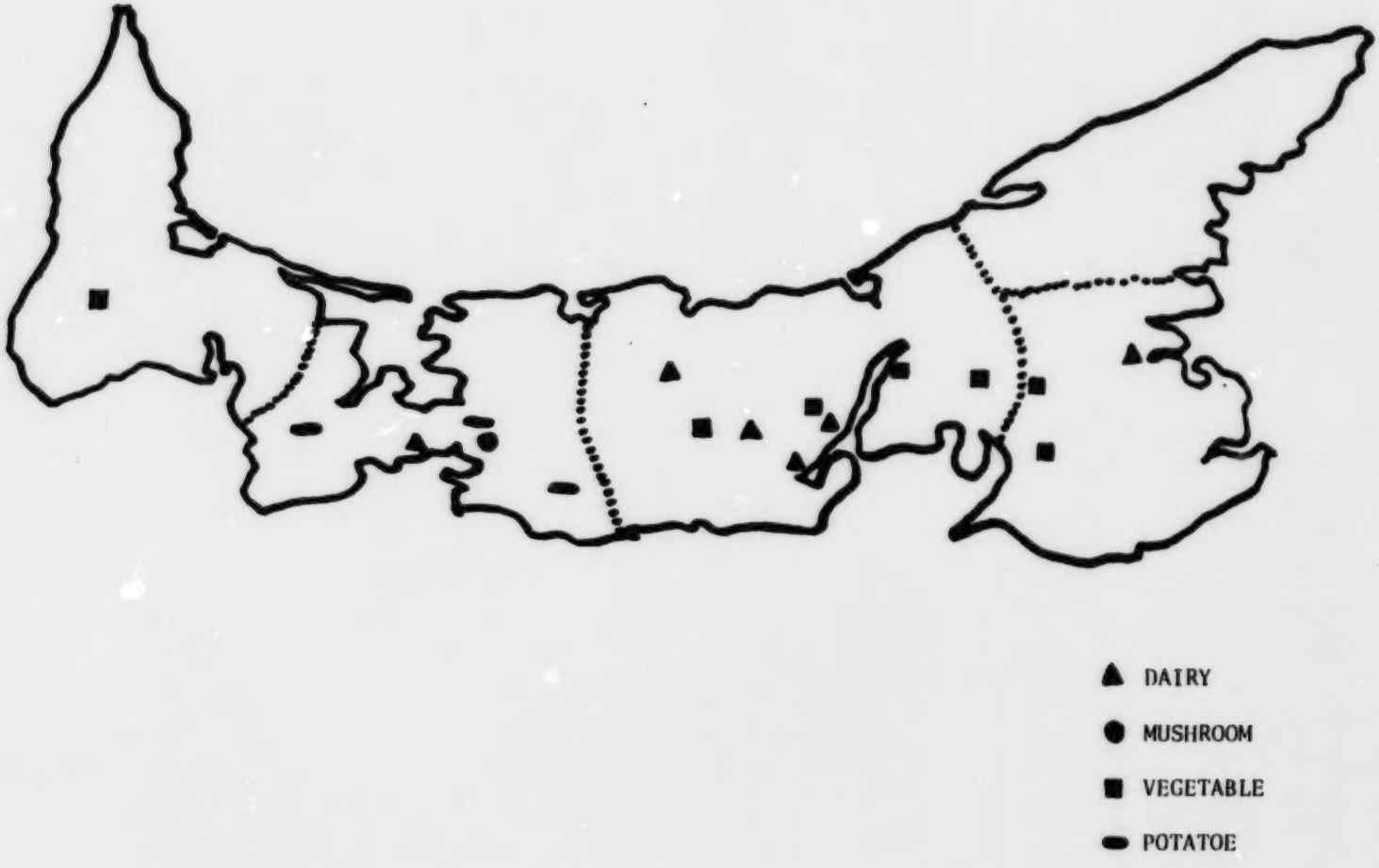
AGRICULTURE DISTRICT	LOCATION	PRODUCT	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	O'Leary	Fresh Veg. Waste	750 T/yr.	all used	all to livestock feed
Summerside	Summerside	Whey	8,000,000 gal/yr.	560,000 gal. contracted	pig feed remainder to treatment plant
	Lower Freetown	Mushroom culls	29,565 cu.ft./yr.	available	landfill
		Spent composte	108,000 cu.ft./yr.	available	some farm compost
	Urbanville	Potato Waste	cull and peel 650 T/yr.	available	cull disposal site
			pick out chips 45 T/yr.	all used	pig feed
	Albany	Potato Sludge	2,000 t/yr. dewatered sludge	unknown	plant start up 1991
	New Annan	Potato (solid)	40,000 T/yr.	all goes to feed	purchase arranged through plant
	New Annan	Potato Sludge	440 T/yr. after expansion	irregularly as ponds are cleaned	landspread on farm fields
Charlottetown					
	Hunter River	Dairy Waste	minimal		
	Wiltshire	Buttermilk	Sum 78,000 gal. Win 26,000 gal.	contracted annually	pig feed
	Royalty Park	Dairy Waste	minimal		disposed
	Charlottetown	Dairy Waste	not valid data		
	East Royalty	Fresh Veg. Waste	1,000 T/yr.	500 T Sept.to Oct. 500 T Nov. to June	all to livestock feed all to livestock feed
	Mt. Stewart	Grading Waste	60 T/season	avail. Sept. to Jan.	all to cattle feed
	Hunter River	Fresh Veg. Waste	94 T/yr.	mid Aug. to June	all to livestock feed
	Crossroads	Fresh Veg. Waste	33 T/yr.	18 T Aug. to Oct. 15 T Nov. to June	all to livestock feed all to livestock feed

cont...

TABLE 5 - FOOD PROCESSING WASTES CONT...

AGRICULTURE DISTRICT	LOCATION	PRODUCT	1990 AMOUNT	AVAILABILITY	PRESENT USE
Montague	Montague	Buttermilk	variable	subscribed	pig feed
	Grandview	Fresh veg. waste	70 T/season	avail. Sept. to Apr.	cattlefeed, composted
	Union Road	Fresh veg. waste	180 T/season	avail. Sept. to Mar.	all to livestock feed

FIGURE 4 - FOOD PROCESSING PLANT LOCATIONS



CHAPTER VII

FOOD SERVICE WASTE

The food services industry was defined to include; produce wholesalers, large grocery outlets with significant produce sections, hospitals and other institutions with food service, major lobster suppers, hotels with banquet facilities and a sampling of restaurants. The food service industry is spread across the province with a concentration in the Charlottetown area. Wastes inventoried were largely kitchen waste and trimmings (i.e. potato peels, vegetable trimmings etc.), returned food not consumed.

All of the hospitals in the province were contacted. Only one was unable to provide an indication of the amount of waste in produced, and as a matter of policy, this hospital dehydrates, compacts and incinerates all kitchen waste so it would be unavailable for any alternative use. The remainder of the hospitals produce about 128 tons of food service waste per year. It is presently garborated, or delivered into the regular garbage stream.

It is interesting to note that seniors lodges, fast food outlets and school cafeterias have minimal amounts of waste. Fast food outlets and school cafeterias take delivery of much of their product in a pre-prepared state, thus minimizing on-site waste. Produce wholesalers also have minimal wastage, since they tend to deal in case lots etc. and the product is not further handled or sorted at the warehouse location.

Organic waste from restaurants varies considerably with management approach as well as the state in which they take delivery of their foodstuffs. Larger banquet capable restaurants tend to do most of the preparation on site, thus creating more kitchen waste. Large operations of this type create between 40 and 65 tons of waste per year. Some "normal" sized restaurants of 40 to 70 seat capacity were interviewed to gain some indication of waste production. These facilities create between 50 and 100 lbs of organic waste per day; 8 to 18 tons per year.

All of the above mentioned waste is produced in relatively small amounts in diverse locations on a daily basis. The majority of it finds its way into the regular garbage collection waste stream. There is not enough at any one location to warrant a separate collection system, however there was a general

concensus that it could be easily separated should there be a system to direct it into a different stream. Increased tippage fees etc. may encourage such a division in waste bins and a revision of the waste collection system to allow for organic garbage separation.

The major lobster suppers located in the North shore tourist area are somewhat unique in the production of food service waste. They create large quantities of waste over a relatively short season in a rural area and disposal is a problem. The three large lobster suppers in New Glasgow, New London and South Rustico generate about 280 tons of waste between June and early October of each year. It is presently all taken to landfills and has to be handled by staff using in-house facilities for handling and hauling. This waste is all within approximately a six to seven mile radius, thus presenting an opportunity for inclusion in a system within minimal transporting. All of the interviewees expressed strong interest in the possibility of an option to the disposal problem that presently exists.

In conclusion, there are 700 to 1000 tons of food service waste disposed of in the province annually. The vast majority of it goes into the regular garbage collection stream. It is diffused throughout the province, with the majority of it concentrated in the Charlottetown area. The form of the waste varies, however it is largely vegetable based waste and scraps with some animal based waste (meat scraps, bone, plate scrapings etc.) and shellfish by-products. Other than in the somewhat unique instance of the North Shore lobster suppers, it is impractical to collect other than by some modification of the existing system. Such a modification may become more attractive with time and increased waste disposal costs. A similar to some degree parallel collection system exists for waste cooking oil already. It is attractive due to the value of the oil for reprocessing into other products. Such a system is deserving of some examination.

TABLE 6 - FOOD SERVICE INDUSTRY WASTE

AGRICULTURE DISTRICT	LOCATION	FACILITY	TYPE OF WASTE	1990 AMOUNT	AVAILIBILITY	PRESENT USE
Province Wide		School Cafeterias	kitchen waste cafeteria waste	minimal minimal	pre-prepared recycled	regular garbage
O'Leary	Alberton	Hospital	Kitchen waste	18 T/yr.	100 lbs/day	garborated
	Tyne Valley	Hospital	Kitchen Waste	18 T/yr.	100 lbs/day	garborated
Summerside	Borden	Cafeteria	kitchen waste	variable		landfill
	New London	Lobster Supper	Lobster & kitchen	90 T/season	1000 lb/day May/Sept.	landfill
	Summerside	Restaurant	kitchen waste	8 T/yr.	50 lbs/day	garborated (sewage)
	Summerside	Hospital	kitchen waste	60 T/yr.	350 lbs/day	landfill
Charlottetown						
	Charlottetown	University Cafeteria	kitchen and cafeteria waste	unknown		regular garbage
	Charlottetown	Training Institute	kitchen waste	36 T/yr.	winter 1 T/wk. summer 1 T/mo.	regular garbage
	Charlottetown	Warehouse	spoiled veg. and fruit	minimal		regular garbage
	Charlottetown	Warehouse	spoiled veg. and fruit	2.5 T/yr.	100 lb/wk.	regular garbage
	Charlottetown	Store Produce	trimmings	15 T/yr.	150 lb/day	regular garbage
	Charlottetown (2 locations)	Store Produce	trimmings	4T/yr.	40 lbs/day	regular garbage
	Charlottetown	Store Produce	trimmings	4T/yr.	40 lb/day	regular garbage
	South Rustico	Lobster Supper	lobster & kitchen	125 T/season	2000 lb/day May/Oct.	landfill

cont...

TABLE 6 - FOOD SERVICE INDUSTRY WASTE CONT...

AGRICULTURE DISTRICT	LOCATION	FACILITY	TYPE OF WASTE	1990 AMOUNT	AVAILABILITY	PRESENT USE
Charlottetown cont.						
	New Glasgow	Lobster Supper	Lobster & Kitchen	65 T/season	75 lb/day Jun/Oct.	Landspread/landfill
	Charlottetown	Restaurant	Kitchen waste	65 T/yr.	500 lb/day	regular garbage
	North River	Restaurant	Kitchen waste	40 T/yr.	300 lb/day	regular garbage
	Charlottetown	Restaurant	Kitchen waste	8 T/yr.	50 lb/day	regular garbage
	Charlottetown	Restaurant	Kitchen waste	18 T/yr.	100 lb/day	regular garbage
	Charlottetown	Fast Food	Restaurant waste	minimal		regular garbage
	Charlettown	Fast Food	Restaurant waste	minimal		regular garbage
	Charlottetown	Seniors Lodge	Kitchen waste	minimal		regular garbage
	Charlottetown	Seniors Lodge	Kitchen waste	minimal		regular garbage
	Charlottetown	Seniors Lodge	Kitchen waste	minimal		regular garbage
	Charlottetown	Hospital	Kitchen waste	36 T/yr.	200 lb/day	regular garbage
	Charlottetown	Hospital	Kitchen waste	unknown	unknown	compacted, dehydrated and incinerated
Montague	Woods Island	Cafeteria	Kitchen waste	unknown		regular garbage
	Montague	Hospital	Kitchen waste	18 T/yr.	100 lb/day	regular garbage
Souris	Souris	Hospital	Kitchen waste	14 T/yr.	80 lb/day	garborated into sewage
			TOTAL	644 Tons		

CHAPTER VIII

WOOD PROCESSING BY-PRODUCTS

This section discusses waste from the forest industry that is accumulated in the post harvest processing of wood. There are two kinds of useable waste that derive from the forest industry on P.E.I.: wood ash from large area and institutional heating facilities and sawdust, shavings and bark from sawmills.

A. Wood Ash

Due to the lack of readily available oil or natural gas and the high cost importing heating fuel or electricity from outside the province, the use of wood (biomass) as an energy source has assumed a high priority on P.E.I. The Prince Edward Island Energy Corporation, a Crown Corporation, has devoted a large portion of its activities toward developing wood energy particularly as a heating alternative, as an acceptable alternative. To this end, some fourteen institutions (hospitals, schools, seniors homes, etc.) now rely on wood chips from poor quality Island forests as a principal source of heat. In addition two District Heating Systems have been installed in Charlottetown to service many institutions and businesses from one wood fired heating centre.

This level of activity has resulted in the production of about 400 tons of wood ash in the province annually from the 16 major facilities. At present almost all of this ash is being disposed of in land fills. Only very small amounts are being experimented with on an ad hoc basis in an attempt to find another more productive method of disposal. The two district heating facilities in Charlottetown produce almost three-quarters of the total provincial total of ash, accounting for about 282 tons annually.

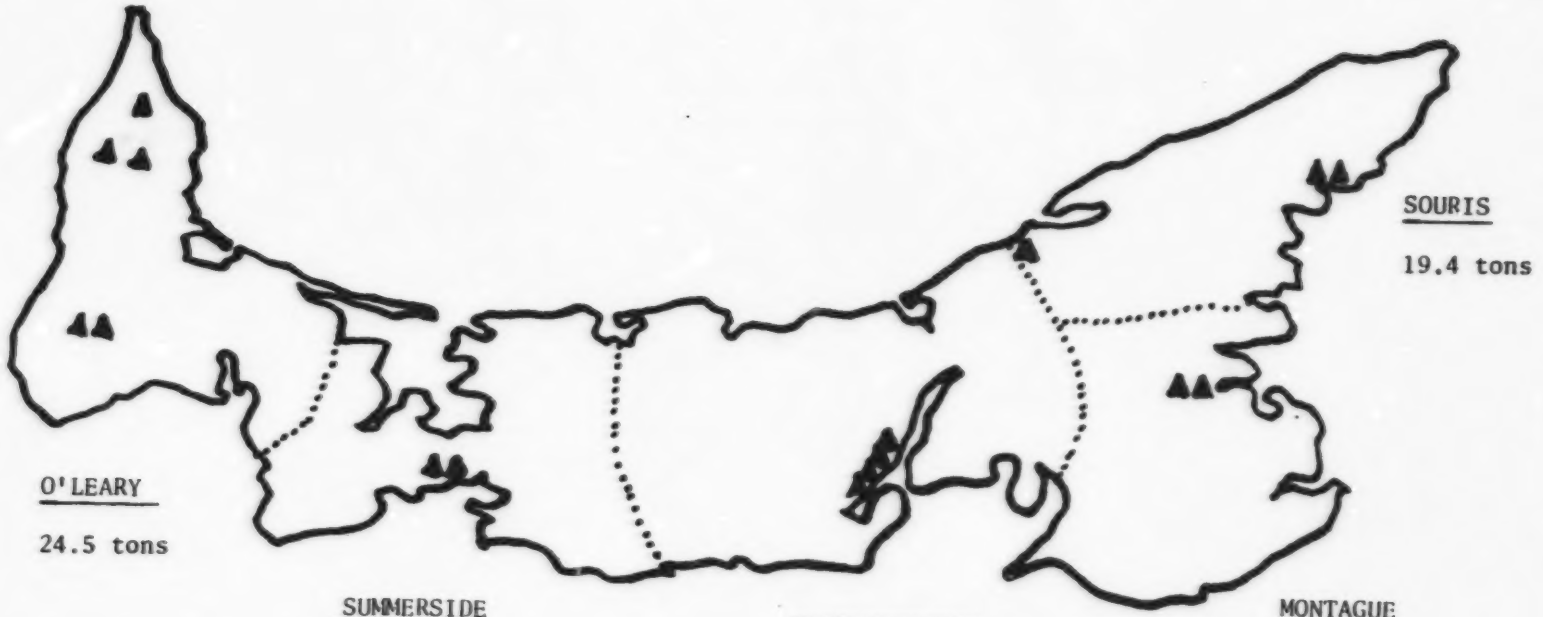
It is important to note that serious consideration is presently being given to construction of a cogeneration (heat and electricity) facility in the Charlottetown area using wood as a fuel. Although it will be a few years before the plant is in operation, it will result in an approximate seven fold increase in large facility wood ash production. It is estimated to produce about 2,600 tons of wood ash annually.

TABLE 7 - MAJOR WOOD ASH SOURCES ON P.E.I.

AGRICULTURE DISTRICT	LOCATION	INSTITUTION	AMOUNT OF WOOD ASH (TONS)
O'Leary	Tignish	M.E.Callaghan School	3.3
	O'Leary	Hernewood School	2.2
	Elmsdale	Westisle School	4.5
	O'Leary	School and Hospital	4.8
	Alberton	Western Hospital	9.7
			24.5
Summerside	Summerside	Wedgewood Manor	3.2
	Summerside	Three Oaks School	10.8
			14.0
Charlottetown	Charlottetown	Sleepy Hollow Centre	3.6
	Charlottetown	Beach Grove Home	4.0
	Charlottetown	UPEI / DH	200.0
	Charlottetown	Prince Edward Home / DH	82.2
			289.8
Montague	Morell	Morell HighSchool	5.7
	Montague	Montague Sr./Jr. High School	11.9
	Montague	Kings County Memorial Hospital	35.1
			52.7
Souris	Souris	Souri Hospital	10.4
	Souris	Senior High School	9.0
			19.4

ISLAND TOTAL 400.4 Tons

FIGURE 5 - LOCATIONS AND AMOUNTS OF WOOD ASH FROM MAJOR FACILITIES



Wood ash has an agricultural value as a soil neutralizing agent as well as a source of macro and micro nutrients. A study done by McCallum and Henry (1989) for the PEI Energy Corporation concluded that there was definite potential for wood ash in both these roles and its recycling into the agricultural system was both timely and opportunistic. The application and transportation of wood ash needs some attention, however these technical problems are assumed to be relatively easily solved.

Although it is noted that the neutralizing and fertilizing values of wood ash vary widely, depending both upon the type and quality of wood used as well as the type of combustion undertaken, samples of wood ash taken from the district heating systems in 1989 showed an average neutralizing value of 86% of limestone by weight. Average Calcium content was 15.6%, Magnesium 1.5%, Phosphorus 1.27% and Potassium 4.2%. Levels of heavy metals in the samples were well within acceptable levels and should not cause any concern to plant production.

A 1991 study by Brinton (Woods End Research Lab.) into the feasibility of composting potatoes on Prince Edward Island identified wood ash as an important component in composting potatoes to adjust the low pH which is a problem in the process. Wood ash made up an average 1% of the compost piles in the 1990 project.

Wood ash from major energy projects appears to have a bright future as a soil and compost amendment. The need for a neutralizing agent as well as the close proximity of agricultural lands to the wood ash sources would indicate an opportunity that needs definition, exploration and refinement. With the potential of a seven-fold increase in the availability of wood ash in the province, it is an opportunity that should be prepared for well in advance to ensure that technology and systems are in place to take ready advantage.

B. Sawdust, Shavings and Bark

Small sawmills scattered across the province are characteristic of the wood processing industry developed to meet local needs. Most of the mills operate seasonally and custom milling forms an economic basis for operation. As part of the inventory all sawmill operators in the province were contacted to determine waste accumulation, use and other details.

As with many other types of operation, the owner-operator has an accurate idea of production but a limited concept of amount of waste produced. It was generally easy to obtain from the sawmiller an indication of the number of cords of wood milled per year or the number of board feet sawed. Based on the fibre audit carried out on sample island sawmills by Spatial Planning Inc. in 1982, it was possible to derive a reasonably accurate estimate of waste for all the mills contacted. This was, in the main, the system used to obtain estimates of sawmill residues for this inventory.

All 27 of the sawmills presently or recently in operation were contacted. In addition, the pulp yard at Georgetown Timber was included in the survey as a large amount of bark from peeling operations has accumulated on that site. There is an average annual accumulation of about 7471 tons of sawdust in the province in addition to about 1450 tons of shavings. Approximately 680 tons of bark have been accumulated at the Georgetown pulp yard over the span of its operations.

Sawdust and shavings in the Montague, Charlottetown and Summerside Districts is usually in demand and rapidly removed from the sawmill site for use as livestock bedding or as fuel for sawdust burners. The O'Leary and Souris Districts are where these materials often accumulate and disposal is somewhat of a problem. This may well be due to the lower numbers of livestock in these two districts, relative to the remainder of the province, or possible alternative sources of bedding for livestock.

Wood by-products have potential for use as a soil amendment and more particularly as a bulking agent for composting. Although small amounts of phosphorus and potassium are available in fresh wood wastes, they are not good sources of nutrients because their decompostition causes soil nitrogen to become immobilized and results in nitrogen deficiencies in crops. Wood wastes can be a useful source of organic matter and addition to sandy soils will improve water retention while addition to heavy soils will increase pore space and aeration.

The major value of wood wastes are as compost bulking agents and to increase carbon:nitrogen ratios in compost mixtures. As an example, the Woods End Research Lab report on Composting Potato Cull on Prince Edward Island (1991) recommended a sawdust component of almost one-half in potato compost piles. They found that sawdust was more suitable to use than barley straw and produced a more satisfactory

end product. As composting becomes recognized as a more efficient method of processing organic wastes for soil enhancement, it is likely that sawdust will become a more valued waste product for the agricultural community. It should also be noted that if a cogeneration plant comes into production, sawdust will be a potential fuel for that process, thus further increasing demand for this product that presently has minimal or no value.

TABLE 8 - SAWMILL WASTES ON P.E.I.

AGRICULTURE DISTRICT	PRODUCT	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	Sawdust	2,770 Tons	Readily available	bedding, heating
	Shavings	118 Tons	Readily available	buried, stockpiled
Summerside	Sawdust	642 Tons	Readily available	bedding, stockpiled
	Shavings	115 Tons	Readily available	
Charlottetown	Sawdust	426 Tons	In demand	bedding, stockpiled,
	Shavings	218 Tons	In demand	burned (fuel)
Montague	Sawdust	3,518 Tons	In demand (small mills)	bedding, burned (fuel)
	Shavings	972 Tons	Some excess	stockpiled
	Bark	680 Tons	Stockpiled	
Souris	Sawdust	115 Tons	Readily available	Stockpiled
	Shavings	30 Tons	Readily available	
	TOTAL:	7,471 Tons Sawdust		
		1,453 Tons Shavings		
		680 Tons Bark		

FIGURE 6 - SAWMILL WASTE DISTRIBUTION ON P.E.I.

SOURIS

Sawdust 115 tons

Shavings 30 tons

O'LEARY

Sawdust 2,770 tons

Shavings 118 tons

SUMMERSIDE

Sawdust 642 tons

Shavings 115 tons

CHARLOTTETOWN

Sawdust 426 tons

Shavings 218 tons

MONTAGUE

Sawdust 3,518 tons

Shavings 972 tons

Bark 680 tons

PROVINCIAL TOTALS:

Sawdust 7,471 tons

Shavings 1,453 tons

Bark 680 tons

CHAPTER IX

FISHERIES BY-PRODUCTS

Being surrounded by water in a province which has the fishery as its second most important economic base after agriculture, it is only natural that Islanders will have long recognized fish and fish by-products as valuable nutrient sources, both for plants and animals. This chapter examines the use and availability of fishery by-products in three sections; finfish, lobsters and mussels. These three aquatic resources account for the majority of the fish landings in the province and almost all of the waste. There is in addition, an active oyster fishery however, processing of oysters for the most part involves grading and external cleaning with little accumulation of waste with any agricultural potential. For this reason the oyster fishery was not included in this inventory.

A. Fin Fish.

As recently as July of 1990 a report; The Preliminary Assessment of the Availability of Fish Waste to Supply a Waste Processing Operation was prepared for the Prince Edward Island Development Agency by the consulting firm of Coopers and Lybrand. Since it was determined that the data presented in this report would be adequate for the needs of this inventory, all the information presented herein is derived from that report. For more detailed information than is included here, readers are refered to the well documented and informative Coopers and Lybrand report, available from the P.E.I. Development Agency or its abridged version.

The fin fishing industry on Prince Edward Island is characterized by extreme fluctuations in both volume of landings and dollar value. Although total landings have been relatively constant over the last decade, landings of individual species have varied widely. In 1989 for example, 37.3 million pounds of groundfish (cod, hake, redfish, flounder, etc.) were landed while 18.1 million pounds of pelagic species (herring, mackerel, etc.) were brought ashore. The landings are distributed in the following pattern: Kings county accounts for 71% of the provincial total, Prince county for 27% and Queens for the remaining 2%. It was

found that waste production generally followed the same trend as landings, that is, approximately three-quarters of the waste was produced in Kings county and one-quarter from Prince county.

Peak fin fish landings, and processing occur in September. The cod landings peak in May and November, hake during July, flounder in August, redfish during October and November. Herring and mackerel are fished for five months of the year; herring landings peak in September and mackerel in June.

Those fish that are primarily filleted; cod, redfish, hake and flounder yield between 60 and 75% waste or by-product. The salting process results in about 35% waste. Herring, which are fished almost exclusively for the yield of roe produce about 5% roe and 95%by-product.

Most of the fin fish waste in the province is transported to a waste processor in Souris. This plant produces fish meal, fish oil, herring meal and herring oil. This appears to be a satisfactory method of disposal except during peak periods when a long delay to unload may be encountered. Fur farmers utilize waste for fox/mink feed on a year round basis. The product is usually frozen and stored on site. Some fish plants sell their waste for bait. Some herring waste is being used as pet food. During peak periods, particularly during the herring fishery when huge amounts of waste accumulate, a portion of the waste may go to landfills.

It was estimated that there was about 15.3 million pounds of fish waste available in 1989. Half of this, 7.9 million pounds, was herring waste. All but 100,000 pounds of this was situated in Kings county.

Usually the disposal of waste remains the responsibility of the processing plant. Price paid or cost incurred depends on several factors, including; bait sells for 5 cents per pound while 3 cents per pound is paid for fox feed, landfilling results in costs for backhoeing etc., the high cost incurred when trucks are detained at Usen fisheries for long periods of time, and the logistical considerations of trucking waste from Prince county to Souris for treatment.

The Coopers and Lybrand study concludes that about 24.3 million pounds of fish waste are available annually. Of this amount, approximately 19.9 million pounds will be processed by Usen Fisheries. The remaining 4.4 million pounds will be used for other products or go to landfill.

The principal limitation to using fish waste as a soil amendment by directly landspreading is smell. Unprocessed fish waste, due to a high lipid content, is extremely liable to become putrid. These odors attract insects and rodents and annoy neighbours. One way of controlling this problem is by composting. Incorporating fish wastes into compost mixtures enhances the nitrogen content and seems to do an adequate job of limiting odour. Sixteen percent of the fish processing firms interviewed recently in Maine now compost their fish wastes. The composting project with potatoes completed in 1990 in P.E.I. incorporated several tons of herring waste into two of the piles late in the composting cycle when it was determined that the C:N ratio was still high. During this activity no excessive odours were experienced.

As a general conclusion, the majority of the fin fish waste in the province is presently well used. The only major exception to this is during the herring fishery, usually in September, when the capacity of the fish waste processing plant is greatly exceeded. Several million pounds of herring waste may be available for alternative uses during that time. One consideration for that excess may be as part of a composting process.

B. Lobster

There were 16 plants processing lobster in Prince Edward Island in the the 1990 season. Attempts were made to contact all of these operations to obtain information for this inventory. Data was obtained from all but four operations, two of which were in receivership, one was out of business and the other in an uncertain future. As in many other industries, many of the operators had a far better knowledge of total product handled than amount of waste or by-product produced. To obtain accurate estimates of by-product, if there was doubt with regard to the amount of waste, an estimate of total product handled was obtained. The P.E.I. Department of Fisheries provided accurate estimates of product yield for the spring and fall lobster fisheries, which were used in the calculations.

The inventory identified an estimated 3,558 tons of lobster waste in 1990. This waste consisted of shells, heads, viscera and unextractable meat. Thirty-eight percent of the waste originated in the Souris district, thirty-one percent from the Montague district and one quarter from the Souris district. The remainder originated from the Summerside district. The majority of the

the lobster waste is accumulated during the spring season, from May 1 to the end of June.

Lobster waste is generally in demand as a soil amendment. In all but two instances, all the lobster waste available is spread on farmland, either forage or disced into cropland. It is generally highly regarded as a soil additive by local area farmers. In most instances it is hauled to the field by the processing plant, or some other loose arrangement is made for its transport. Only rarely is a monetary transaction involved, both parties seeing benifit from the arrangement. About 175 tons (5%) of the total waste goes unused to landfills. These two plants which landfill waste expressed interest in exploring an alternative arrangement for waste which would result in a more productive use.

C. Mussels

The cultured mussel industry that has recently developed on Prince Edward Island has created a new by-product with potential for farm use; mussel offal. This is the mixture of bottom mud, broken and undersized mussels, bysus threads and other material that is cleaned off the mussels in preparation for sale.

There are five plants in the province presently processing mussels and producing this waste product. It is available year round in the Summerside, Charlottetown, Montague and Souris districts. An estimated 475 tons per year is presently accumulating. In 1990 only about 125 tons was used as a soil amendment on vegetable land, the other 350 tons is going to public or private landfill sites.

A July, 1989 analysis of mussel offal indicated calcium levels in excess of 2000 ppm, potassium of 1500 ppm, phosphorus at 350 ppm, sodium levels at 5000 ppm and sulphate levels of 4032. The pH was 6.5 (a neutralizing value of 83% of limestone) and organic matter was 7.6%.

There is potential for using the material that is presently being landfilled, either as a direct application or as a compost component. As the mussel industry develops, more product will likely become available. Spreading is a problem at present, however a modified manure spreader that will break up the waste to a smaller particle size would probably alleviate this problem.

TABLE 9 - LOBSTER AND MUSSEL WASTE ON P.E.I.

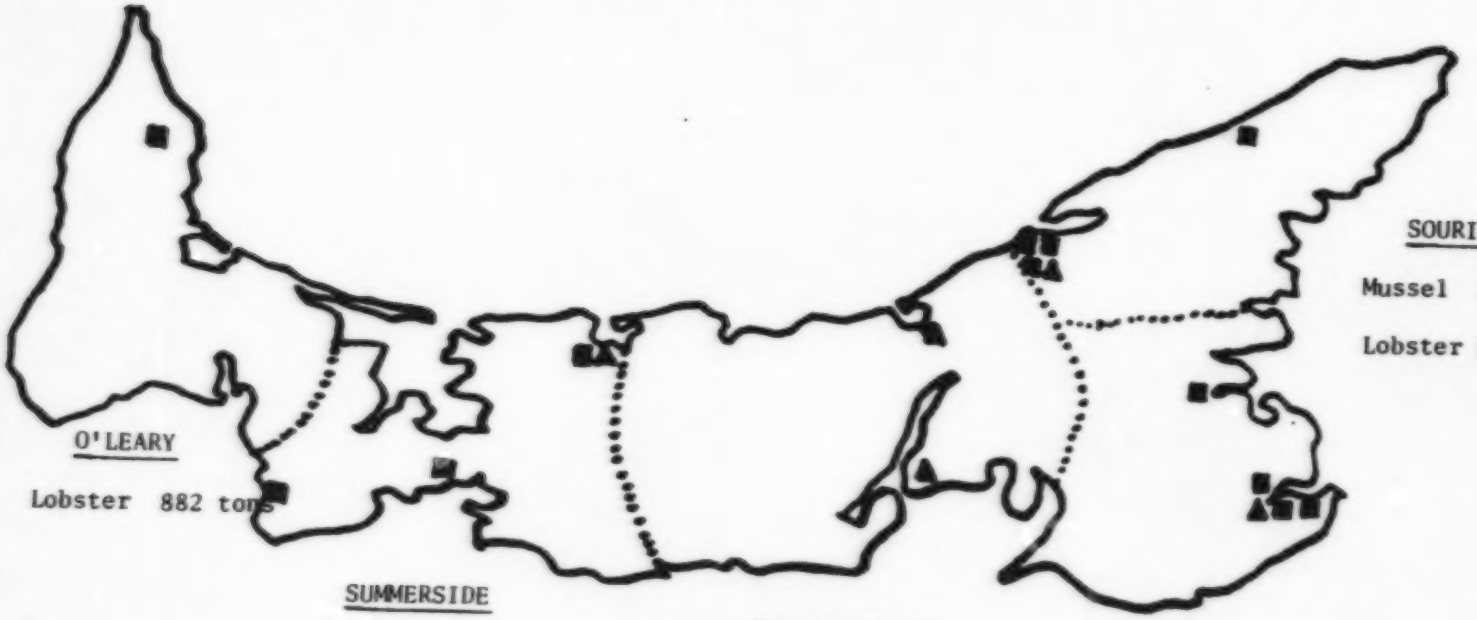
AGRICULTURE DISTRICT	LOCATION	PRODUCT	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	Tignish	Lobster waste	882 T/season	550 T/spring 332 T/fall	spread on farmland spread on farmland
Summerside	New London	Mussel offal	50 T/yr.	available	dumped in landfill
	Summerside	Lobster waste	55 T/season	available/spring	hauled to landfill
	New London	Lobster waste	150 T/season	all used	spread on farmland
	Abrams Village	Lobster waste	25 T/yr.	all used	spread on farmland
Charlottetown					
	Tracadie	Mussel offal	25 T/yr.	all used	spread on farmland
	Vernon Bridge	Mussel offal	100 T/yr.	all used	spread by vegtable grower
	Beach Point	Lobster waste	100 T/season	all used (spring)	pread on farmland
	Beach Point	Lobster waste	200 T/season	150 T/spring 50 T/fall	spread on farmland
Montague	Murray River	Mussel offal	100 T/yr.	available	buried on property
	Georgetown	Lobster waste	500 T/yr.	all used	all used -- bodies to paste shells landspread
	Gaspereaux	Lobster waste	600 T/season	all used (spring)	spread on farmland
Souris	St. Peters Bay	Mussel offal	200 T/yr.	available	buried on property
	Morell	Lobster waste	150 T/season	all used	bodies to paste shells landspread
	Morell	Lobster waste	726 T/yr.	594 T/spring 132 T/fall	spread on farmland
	Morell	Lobster waste	350 T/yr.	200 T/spring 150 T/fall	spread on farmland

cont...

TABLE 9 - LOBSTER AND MUSSEL WASTE ON P.E.I. CONT...

AGRICULTURE DISTRICT	LOCATION	PRODUCT	1990 AMOUNT	AVAILABILITY	PRESENT USE
Souris cont.	North Lake	Lobster Waste	120 T/season	available	buried in landfill
		TOTAL LOBSTER WASTE	3,558 tons		
		TOTAL MUSSEL OFFAL	475 tons		

FIGURE 7 - DISTRIBUTION OF LOBSTER AND MUSSEL WASTE ON P.E.I.



TOTAL MUSSEL 475 TONS

TOTAL LOBSTER 3,558 TONS

▲ MUSSEL PLANTS

■ LOBSTER PLANTS

CHAPTER X

SEAWEED

Seaweed, marine algae growing and/or accumulating in the intertidal zone, has a long history as a soil amendment in all coastal communities where agriculture is practiced to any extent. While it is not a "waste product" in the strictest definition, it is in many cases a problem and disposal or control can be time consuming and expensive, if it is possible at all.

Wind and water tossed marine algae has been used for hundreds of years essentially unprocessed as a mulch and green manure by farmers and gardeners. In more recent times, the value of seaweed has been recognized and an industry has developed processing the product into a more transportable and usable form, either throught drying and grinding or developing a concentrated extract. As a general guideline seaweed contains the macro-nutrients, N, P and K in amounts roughly similar to animal manure. Potassium is usually present in the largest concentration, followed by Nitrogen and generally a low amount of Phosphorus. There is a wide range of trace elements available in most seaweed and it varies widely with species composition and growing location. It is interesting to note that a number of researchers believe that the presence of growth regulating substances (Cytokinins) in seaweed cause increased plant growth, accounting for the impact of seaweed on plant growth that cannot be wholly explained by the nutrient content.

One of the major concerns with regard to using seaweed as a soil amendment, whether processed or "green" is the possibility of salt buildup in the treated soil over a long period. This was studied at the Ark at Spry Point during its research phase and no appreciable increase in salt levels was discovered. It should also be noted that seaweed was said to contribute to the scabbing of potatoes when it was used on Island fields prior to the availability of fertilizers.

In this inventory, the availability of seaweed was explored only where it was a problem, for example around swimming and beach areas or as a waste product in the Irish Moss industry or where its use was being developed as an industry.

The Town of Summerside has had a problem with seaweed drifting into the shoreline of the town for many years. As it decays during the warm summer months it can cause a major odour problem in the town and adjacent municipality of St. Eleanors. There are layers of seaweed several feet deep overlain with sand along the harbour seawall and in addition, it collects constantly along the beach to the west of the town centre. Town officials have tried to remove it from along the shore but it was found to be impossible to keep up with the accumulation of it during the mid and late summer. The seaweed is up to 98% eel grass according to an examination carried out by University of Prince Edward Island personnel some years ago. Needless to say, any proposal to remove it would be readily considered by the town.

A problem similar to that of Summerside exists at two south shore provincial parks: Linkletter Provincial Park and Tea Hill Provincial Park. In addition to an odour problem, it can limit the pleasure of bathing and using the shoreline in these recreation areas. The seaweed accumulates continuously throughout the summer months with onshore winds. It is on a hard sandy shoreline readily accessible by wheeled machinery. Parks would support and encourage its removal.

The National Parks on the north shore have occasional problems with seaweed, particularly in the Dalvay area, but as a matter of policy, it cannot be removed from the Park.

All of the active Irish Moss depots purchase only clean dry moss so cull product is not accumulated. There is presently 250,000 lbs. of poor quality Irish moss stored in one warehouse in Miminegash. The owner is considering further processing to sell it as a fertilizer.

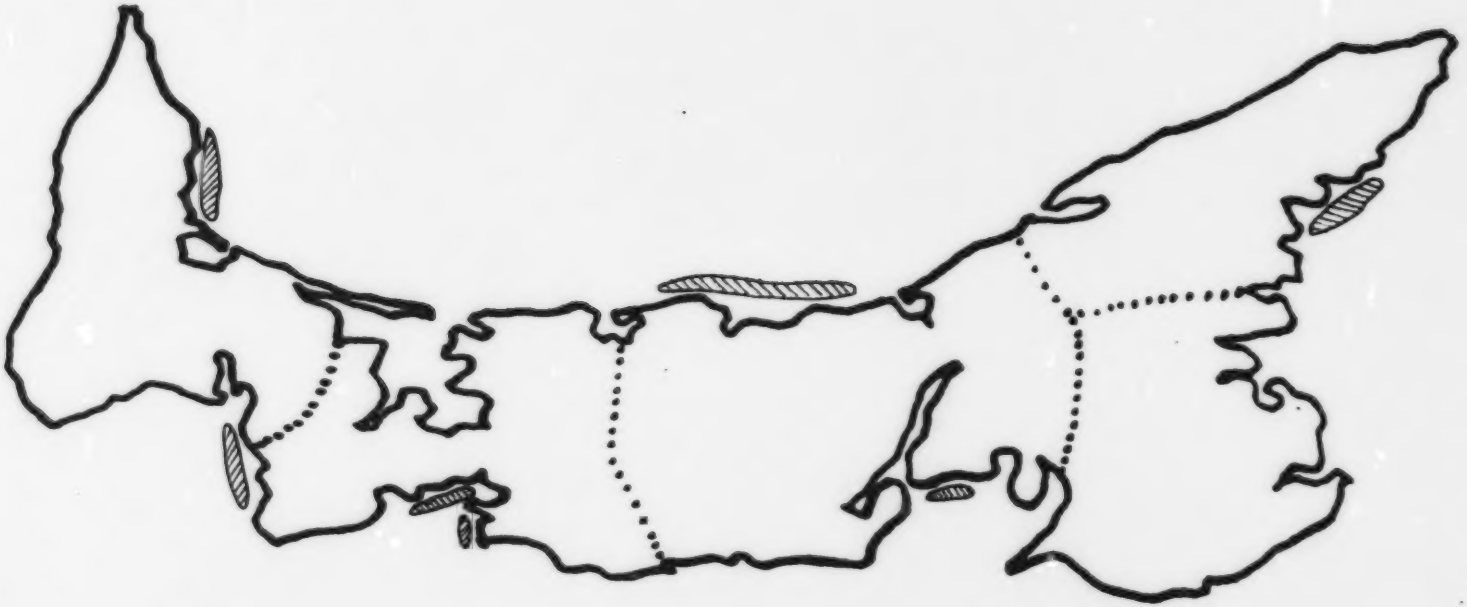
It is of interest to note that an organic fertilizer plant has just been constructed in the Egmont Bay area in the summer of 1990. It is designed to make use of storm tossed seaweed as the basis for a fertilizer to sell to gardeners. Presently the plant is capable of processing a minimum of 400 tons per year of Fucus spp. with a maximum capacity of 1000 tons per year. In addition to seaweed, they are exploring the potential of lobster bodies, herring waste and peat moss as components for a more complete product.

At present, there is no estimate of the amount of seaweed that is available and has some disposal problem, however, it is considerable. For the most part, problem seaweed accumulation is concentrated along the south shore of the Island. Annual seaweed accumulation varies greatly, its abundance to a large degree being determined by mean summer water temperature and more important, the prevalence of onshore winds. In locations where it is a problem, a proposal to remove it would meet with an enthusiastic response, however, permission from the Department of Environment would be a prerequisite to any intertidal activity. The product is for the most part unused and it is in all cases owned by the crown, with the possible exception of some foreshore lease interests.

TABLE 10 - LOCATIONS OF EXCESS OR PROBLEM SEAWEED

LOCATION AND FACILITY	AVAILABILITY	PRESENT USE
Anglo Tignish (Plant)	none available	dry, clean moss only
Linkletter Provincial Park	unused - major problem	not hauled due to cost
Summerside Shore	unused - there for taking	not hauled
Miminegash (Moss Plant) (warehouse)	250,000 lbs. dry (moss pick-outs)	processed product for sale
Abram's Village (fertlizer Plant) Egmont Bay	none available	processed organic fertilizer
Miminegash (Plant)	none available	dry, clean moss only
Tea Hill Provincial Park	unused - major problem	not hauled due to cost
Miminegash (Moss Plant) Nafrage Shore	none available	dry, clean moss only
National Parks	not available - Parks Policy	moved along shore as necessary

FIGURE 8 - LOCATION OF EXCESS OR PROBLEM SEAWEED



SEAWEED LOCATIONS

CHAPTER XI

HARBOUR DREDGINGS

The province has four designated industrial ports; Charlottetown, Georgetown, Souris and Summerside. In addition there are numerous small boat harbours situated around the circumference of the province as well as two ferry boat harbours. These are dredged on an as needed basis under the administration of Public Works Canada at the request of the Coast Guard in the case of industrial ports and Fisheries and Oceans Canada in the case of small boat harbours.

A maximum of ten sites per year are dredged on Prince Edward Island including land based dredging in the immediate vicinity of wharves. Dredging work concentrates on opening restricted channels and clearing wharves. All materials are relocated at sea in the case of floating dredges or hauled to a convienient land disposal site when the work is land based.

In discussion with officials from Public Works Canada it was determined that essentially all materials dredged around the Island are exclusively sand. There is little or no organic matter in the dredged materials, even in the case of the industrial harbour sites. Some material was examined several years ago and was concluded to have no value for agriculture.

Other industrial harbours in the Maritimes that are dredged regularly contain a highly organic, flocculated muck that has been considered as a soil amendment, however in almost all cases it is at least lightly polluted particularly with heavy metals. It is usually disposed of at sea, or if this is not allowed due to environmental restrictions, it is brought ashore and transfered to industrial land fill sites.

It was concluded that there is no usable waste products suitable for farm application to be aquired from harbour dredging operations, either in the province or from adjacent provinces.

CHAPTER XII

SEWAGE SLUDGE

Approximately one-half of the homes in the province are connected to some form of municipally owned waste treatment facility. The other half are responsible for their own waste management, usually with a septic tank and field discharge system. Sewage sludge is the material that is removed from these treatment facilities as an end product of the decomposition process. Sewage sludge is included in this inventory because disposal is a problem and, despite concerns over its use, it is in many cases an excellent source of crop nutrients.

A. Municipal Waste Treatment Facilities.

There are twenty-five municipalities with some form of communal waste treatment in the province. Two have secondary treatment plants, three have primary treatment and the remaining twenty use lagoons for treatment. Primary treatment settles out the solids from the water. The secondary step involves bacterial decomposition of the solids that were not removed during the primary step. Lagooning involves putting the waste water into holding ponds, or lagoons where solids are digested aerobically and/or anaerobically. The solids then settle and the water is disinfected and discharged.

The primary treatment plants are servicing the greater Charlottetown area and the Town of Summerside. They are actively managed facilities with staffs committed to their operation. In the case of Charlottetown, although there is wide variation in sludge removal based on a three year cycle, about 507 tons of sludge was removed in 1990. By comparision, in every third year, when the digester is cleaned out, about 7,000 tons of sludge is hauled away. The digested sludge from the Charlottetown plant is used by the contractor who removes it as a soil amendment. The Summerside facility is cleaned constantly, with about 15 tons of chlorinated wet sludge being hauled to a land fill site weekly. Sludge disposal for the Town of Summerside is a problem and with tippage costs coming into effect, will cost some $16,000 annually.

Secondary treatment facilities in Montague and Souris are reported to have no significant accumulation of sludge to date.

Nearly all of the lagoons in the province were constructed fifteen to twenty years ago as part of the Comprehensive Development Plan. Only three of them have been cleaned out since their construction. Two were cleaned in 1988 and one in 1990. In these instances the sludge was disposed of on hayfields in the general vicinity. The average design life for a lagoon is about 15 years before cleaning is required so most of the lagoons in the province are nearing capacity and shall have to be cleaned in the near future.

It was not possible to determine the actual amount of sludge that has accumulated in lagoons in the province, however some theoretical values were obtained. From literature review and discussion with Paul Klamass, of Environment Canada in Halifax, it was determined that the average accumulation of sludge per resident per twenty years was approximately 41 cu. ft. which was converted to 1.3 tons. By determining municipal populations, it was then possible to estimate the amount of sludge accumulated in the lagoons in the province. While it is an estimate subject to wide variation, it is none the less indicative that there is a large accumulation of sludge in the province; somewhere in the vicinity of 20,000 tons in total.

This volume of potentially useful product necessitates some attention if it is to be used to its full value, particularly since it will no doubt become available within the next few years. Sewage sludge in general should make a good soil amendment since it is usually high in nitrogen (N), phosphorus (P_2O_5), calcium and organic matter which can vary from 40 to 60%. Due to its high pH value sludge should also have some liming affect on acid soils (Seekins, 1988). Sludge is usually low in potassium and may require adjustment for that nutrient. The concentration of nutrients in sludge varies widely so it is important to have specific test data for the treatment plant or lagoon of interest. One potential problem in other jurisdictions is the possibility of high levels of heavy metals and other toxic compounds when industrial waste goes into the domestic waste stream. This is of very limited concern on Prince Edward Island since there is little industrial development that would cause this problem. The only area

where this might be of concern is in the Charlottetown Area Treatment Plant and an examination of regular samples shows no significant levels of heavy metal accumulation.

Most of the small municipalities whose lagoons will require cleaning in the next several years will be facing a cost of several thousand dollars to have this work done. Any way that this could be reduced by assigning a value to the sludge as a soil amendment would be likely treated with enthusiasm by the municipalities concerned.

Sludge can be used either by direct application as a soil amendment or by composting. One of the constraints with regard to direct application is the possibility of disease causing pathogens coming into contact with food destined for human consumption. As a matter of principle, sludge is only spread onto pasture or hay land, or other such crops that are not being sold directly for human consumption.

In many municipalities, sludge is being composted and sold as a stable, value added product. The City of Kelowna, in British Columbia has developed a successful system for composting its sewage sludge (Stevens, 1989). Proper composting with a good bulking agent such as sawdust or straw, ensures that adequate temperatures are reached in the process to successfully destroy all pathogens in the sludge.

At present a permit to spread sludge onto land is required under the regulations to Environmental Protection Act. The P.E.I. Department of Environment is responsible for that Act.

B. Private Septic Systems.

About half of the homes in the province accomplish waste disposal with an individual septic tank and field tile system. On average, these tanks require cleaning approximately every three years. Disposal varies from spreading onto hay land, being dumped into municipal systems and being "hauled to the woods". In some cases proper disposal of septic tank sludge is something of a local problem. Based on an average three year rotation, about 1800 tons of sludge is removed from septic tanks annually. It has most of the same characteristics as domestic sewage sludge, however there will be a wide variability due to the extreme range of operating efficiencies of individual systems.

TABLE 11 - SEWAGE SLUDGE DISTRIBUTION AND AVAILABILITY

AGRICULTURE DISTRICT	LOCATION	FACILITY	TYPE OF WASTE	1990 AMOUNT	AVAILABILITY	PRESENT USE
O'Leary	Alberton	Lagoon	sludge	1,434 T	cumulative	
	O'Leary	Lagoon	sludge	1,070 T	cumulative	
	Tignish	Lagoon	sludge	75 T	cumulative	
Summerside	Summerside	Primary Treatment	sludge	780 T/yr.	2 truck loads per week	landfill
	Borden	Lagoon	sludge	668 T	cumulative	
	Kensington	Lagoon	sludge	1,437 T	cumulative	
	Abrams Village	Lagoon	sludge	434 T	cumulative	
	Crapaud	Lagoon	sludge	432 T	cumulative	
	Kinkora	Lagoon	sludge	333 T	cumulative	
	Miscouche	Lagoon	sludge	880 T	cumulative	
	St Eleanors	Lagoon	sludge	100 T	cumulative	
	Tyne Valley	Lagoon	sludge	243 T	cumulative	
	Wellington	Lagoon	sludge	527 T	cumulative	
Charlottetown	Charlottetown	Primary Treatment	sludge	507 T/yr.	presently all used under contract	landspread
	Bunbury	Lagoon	sludge	1,370 T	cumulative	
	Cornwall	Lagoon	sludge	150 T	cumulative	cleaned out 1988

cont...

TABLE 11 - SEWAGE SLUDGE DISTRIBUTION AND AVAILABILITY

AGRICULTURE DISTRICT	LOCATION	FACILITY	TYPE OF WASTE	1990 AMOUNT	AVAILABILITY	PRESENT USE
Charlottetown cont.						
	E. Royality	Lagoon	sludge	2,650 T	cumulative	
	Mt. Stewart	Lagoon	sludge	447 T	cumulative	
	North River	Lagoon	sludge	2,252 T	cumulative	
	North Rustico	Primary Treatment	sludge	270 T	cumulative	
	Southport	Lagoon	sludge	1,717 T	cumulative	
Montague	Montague	Secondary Treatment	sludge	no sludge accumulation		
	Georgetown	Lagoon	sludge	948 T	cumulative	
	Morell	Lagoon	sludge	462 T	cumulative	
Souris	Souris	Secondary Treatment	sludge	no sludge accumulation		
	St. Peters Bay	Lagoon	sludge	345 T	cumulative	
Province Wide		Septic Tanks	raw sewage to sludge	1,788 T/yr.	unknown disposal a problem	unknown
			TOTAL	21,319 Tons		

FIGURE 9 - SEWAGE SLUDGE DISTRIBUTION

PROVINCIAL TOTAL ACCUMULATED SEWAGE SLUDGE 19,456 tons

HOUSEHOLD SEPTIC TANKS PER YEAR 1,788 tons

▲ PRIMARY TREATMENT PLANT

■ SECONDARY TREATMENT PLANT

● SEWAGE LAGOON

CHAPTER XIII

MUNICIPAL LEAF AND YARD WASTE

Charlottetown and Summerside are the only municipal areas which have specific organic waste collection periods in the spring and/or fall which accumulate significant volumes of product. In both cases leaves and organic yard waste are disposed of in land fills. However, both jurisdictions plan to begin composting this material in 1991 and using the compost for city and town parks maintenance. It will therefore no longer be available as a waste product.

It is estimated that Charlottetown accumulates approximately 140 tons of leaves etc. in its four to six week fall clean-up. Summerside accumulates approximately 100 tons annually, some 90% of it during the fall clean-up and the remaining 10% during and annual spring clean-up.

CHAPTER XIV

SUMMARY AND CONCLUSIONS

In general, Islanders are a frugal lot. In many instances, what would be considered waste in another society is recognized as a resource of some value here. The most striking example of this is certainly the finding that about 99% of the total animal manure produced each year on the Island never leaves the farm on which it originated! The majority of the potato cullage finds its way to the cattle feedlots of the province, sawdust and shavings from many of the sawmills are used as fuel or livestock bedding, livestock growers form lines waiting for the cull root vegetables and cole crops from the vegetable grading warehouses. Only two of the sixteen lobster processing plants in the province haul their waste to a landfill, the rest of it is in demand to be spread on fields as a fertilizer.

The above is not intended to lead one into an unduly smug state with regard to the recycling of waste with a potential on farm use. There are still many opportunities to explore with regard to waste useage. There are many types of waste that are presently not utilized, under utilized or considered disposal problems. These are summarized in Table 13. It is of note that about 2,700 tons of manure are not used annually in the Charlottetown district. In addition, between 15,000 and 25,000 tons of cull potatoes, as a minimum, go annually to cull burial sites. These wastes coupled with 2,200 tons of herring that are normally landfilled, 3,600 tons of sawdust and shavings that are accumulated and 400 tons of wood ash hauled to land fill sites, would seem to be all of the ingredients of a higly desirable compost. Only the logistics of getting it all together are lacking.

The many municipal lagoons in the province that are nearing capacity would seem to offer a major opportunity for on farm use. The literature abounds with information on using sewage sludge either directly as a soil amendment or alternatively, in a composting process. It would be unfortunate if the nutrients that have accumulated for the last twenty or so years were poorly used, or worse, not used at all in a beneficial manner.

TABLE 12 - A SUMMARY OF USEABLE WASTE PRODUCTS FOR THE FARM, PRINCE EDWARD ISLAND

WASTE PRODUCT	O'LEARY	SUMMERSIDE	CHARLOTTETOWN	MONTAGUE	SOURIS	PROVINCIAL TOTAL
ANIMAL MANURE:						
Hog (liquid)	422,000 gal	470,000 gal	465,000 gal			1,357,000 gal
Hog (dry)	230 T	200 T				430 T
Poultry (hen)		700 T	625 T	300 T		1,625 T
Poultry (broiler)		480 T				480 T
Cattle		3,200 T				3,200 T
Horses		200 T	2.450 T			2.650 T
Mix Manure			950 T			950 T
WOOD PROCESSING:						
Wood Ash	25 T	14 T	290 T	53 T	20 T	404 T
Sawdust	2,770 T	642 T	426 T	3,518 T	115 T	7.471 T
Shavings	118 T	115 T	218 T	972 T	30 T	1.453 T
Bark				680 T		680 T
FISHERIES BY-PRODUCTS:						
Mussel Offal		50 T	125 T	100 T	200 T	475 T
Lobster Waste	882 T	230 T		2,626 T	120 T	3,858 T
Fin Fish Waste						7.650 T
FOOD PROCESSING:						
Buttermilk						104,000 gal
Whey						8,000,000 gal
Mushroom Culls		29,565 cu ft				29,565 cu ft
Spent Compost		108,000 cu ft				108,000 cu ft

cont...

TABLE 12 - A SUMMARY OF USEABLE WASTE PRODUCTS FOR THE FARM, PRINCE EDWARD ISLAND CONT...

WASTE PRODUCT	O'LEARY	SUMMERSIDE	CHARLOTTETOWN	MONTAGUE	SOURIS	PROVINCIAL TOTAL
FOOD PROCESSING CONT.						
Vegetable Waste						2,187 T
Potato Processing						
(solid waste)		40,695 T				40,695 T
(sludge)		2,440 T				2,440 T
MEAT PROCESSING:						
Offal	80 T	152 T	4,930 T	113 T		5,275 T
Blood			316,000 gal	36,000 gal		352,000 gal
FOOD SERVICES:						
Kitchen Waste	36 T	68 T	508 T	18 T	14 T	644 T
MUNICIPAL SLUDGE:						
Sewage Sludge	2,504 T	5,834 T	9,363 T	1,410 T	345 T	19,456 T
Household Septic Tanks (per year)						1,788 T
POTATO CULLAGE:						min. 15,000 T not fed
WASTE HAY:						16,000 T

Presently over 5,000 tons of slaughterhouse waste leaves the province annually. It is used in other facilities, but one questions whether the value of minerals and nutrients lost is worth the convenience of being relieved of waste. A recent newspaper report indicated that a processor from another province had expressed interest in collecting lobster bodies from Prince Edward Island to be processed into a fertilizer. Another waste resource being largely put to good use is being considered for export for the sake of convenience.

The cultured mussel industry, quite new to Prince Edward Island, has resulted in a new type of waste with agricultural potential, mussel offal. This waste compound has notable value as a soil amendment and presently about 350 tons is annually going to land fill sites. Another marine resource of value but little used is seaweed. Unknown but substantial amounts of it cause problems in recreation and urban locations along the south shore annually. It would seem to have a potential as a soil amendment and would relieve several areas of an ongoing problem.

The response from the many persons interviewed during the inventory was almost universally positive. Many went to considerable lengths to supply data that was as accurate as possible. They all expressed interest in the project and were supportive in the attempt being made to gather information aimed at making better use of what is presently considered as waste.

A general conclusion from the inventory is that there is an extreme variation in availability of many waste products from year to year. This is particularly true of the herring fishery, the cull potato waste and abundance of problem seaweed. It is also of note that, should a wood energy cogeneration plant come into operation, the production of wood ash will increase almost sevenfold to some 3000 tons per year. This type of wide variation in waste product availability makes it apparent that any system or program considered to take advantage of utilizing waste will have to be extremely flexible and opportunistic. It is obvious that this requirement makes planning and/or fiscal analysis extremely difficult to undertake.

TABLE 13 - WASTE PRESENTLY NOT UTILIZED, UNDER UTILIZED OR DISPOSAL PROBLEMS

TYPE OF WASTE	APPROXIMATE AMOUNTS	VARIABILITY	COMMENTS
MANURE			
Chicken	1,000 T annually	constant	all manure in Charlottetown area
Horse	1,200 T annually	constant	
Exhibition	500 T annually	constant	
HAY	16,000 T annually	extremely variable	province wide
POTATOES	15,000 - 25,000 T annually	extremely variable	
BLOOD	352,000 gal. annually	constant	
MUSHROOM CULLS	30,000 cu. ft. "	constant	
SPENT COMPOST	108,000 cu. ft. "	constant	
WHEY	8,000,000 gal. annually	constant	
LOBSTER SUPPER WASTE	280 T annually	constant	concentrated on the North Shore area
ASH	400 T annually	constant	will increase to 3000 T with cogeneration plant in O'Leary, Summerside
SAWDUST & SHAVINGS	3,680 T total	cumulative	Souris Districts
BARK	680 T total	cumulative	Georgetown
HERRING	2,200 T annually	extremely variable	in Sept. Kings County
LOBSTER	175 T annually	variable	May, June Summerside and North Lake
MUSSEL	350 T annually	constant	
SEAWEED	unknown	extremely variable	South Shore locations
SLUDGE			
Sewage	21,000 T total	cumulative	
Processing	400 T annually	constant	will expand to 2000 T with industry expansion

Even as it is pointed out that Islanders generally make use of many of the waste products inventoried, an obvious question is how efficiently and to what degree are these waste products being recycled? This question cannot be answered by the inventory but it is an issue that may well be addressed using the inventory as a starting point. There may well be better and more effective ways of using wastes such as manure, potato sludge and lobster bodies than simply land spreading. As these by-products come to be considered more as a valued source of nutrients and physical soil enhancements and less as wastes to be disposed of, answers to this question will be sought.

The inventory provides insight into the amounts, locations and qualities of wastes that have potential on farm use. Creative thought and planning will be required to make use of those materials presently going unused and creating disposal problems, as well as searching for ways and methods to ensure that materials presently being used are providing maximum benefit and opportunity to the Island agricultural community.

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